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| 10/584,407 | 06/26/2006 | Paul Joseph Brooks | 1033963-000026 | 9864 |

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| EXAMINER | |
|---|---|
| INYARD, APRIL C | |

| ART UNIT | PAPER NUMBER |
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| 4152 | |

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**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

ADIPFDD@bipc.com

| Office Action Summary | Application No. | Applicant(s) | |
|---|---|---|---|
| | 10/584,407 | BROOKS, PAUL JOSEPH | |
| | Examiner | Art Unit | |
| | APRIL C. INYARD | 4152 | |

*-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --*

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

1)☐ Responsive to communication(s) filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

4)☒ Claim(s) *1-20* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-20* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

**Application Papers**

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *26 June 2006* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☒ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. 10584407.

3.☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *10/27/08*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

## DETAILED ACTION

### *Priority*

1. Acknowledgment is made of applicant's claim for foreign priority based on an application filed in:

a. GB on May 20, 2005

b. EP on May 20, 2005

It is noted, however, that applicant has not filed a certified copy of the GB0510317.1 or EP05270017.6 applications as required by 35 U.S.C. 119(b).

### *Claim Objections*

2. Claim 1 is objected to because of the following informalities: The use of the terminology "adapted to" is given little weight in interpretation of Claim 1 as the scope of the claim makes optional but does not require steps to be performed and does not limit the claim to a particular structure, *see MPEP 2111.04 "Adapted to" Clauses.*

Furthermore, with respect to the wavelengths for the "far infrared" range of the instant claim are not defined in the disclosure as a special subset of wavelengths within the infrared spectrum and that the range of the instant claim "2.5 to 50 micrometers" is actually within the standard range accepted to be defined as middle infrared, mid-infrared. Therefore, the Examiner interprets the instant claim toward "far infrared" to mean anything within the infrared wavelength range as defined. Appropriate correction is required.

*Claim Rejections - 35 USC § 112*

3. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

4. **Claims 1-6 and 9-20 are rejected under 35 U.S.C. 112, second paragraph**, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

**Claims 1 and dependent claims 2-6 and 9-20** are indefinite because they fail to set forth the composition or structure of the thermal control film and only claim properties of the thermal control film multi-layer interference filter. Claims that merely set forth physical characteristics desired in an article, and not setting for specific compositions which would meet such characteristics are invalid as vague, indefinite, and functional since they cover any conceivable combination of ingredients either presently existing or which might be discovered in the future. The specification does not give examples, or any direction whatsoever, towards determining what materials do and do not constitute a material with these properties.

5. **Claims 5 and 13-19 are rejected under 35 U.S.C. 112, second paragraph**, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

**Claims 5 and 13-19** recite the limitation "wherein the film is in the form of a liquid coating to be applied to a surface."

a. There is insufficient antecedent basis for this limitation in the claim. The disclosure provided neither provides an example nor a technical description of a liquid composition that may be used as a thermal control film for a spacecraft.

b. **Claim 13** directly depends from Claim 12. Due to the limitations of Claim 12, wherein the film is in the "form of a flexible sheet", Claim 13 thus rendered indefinite because the thermal control film cannot simultaneously exist as a flexible sheet and liquid coating.

c. It is unclear how the "film" of Claims 5 and 13, which has not yet been applied to the surface of a spacecraft, can exist both as a film and a liquid, particularly as a liquid with multiple polymeric layers or in the form of a tile. These inconsistencies therefore make Claims 5 and 13, and dependent claims 14-19 vague and indefinite.

### *Claim Rejections - 35 USC § 102*

6. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.
>
> (f) he did not himself invent the subject matter sought to be patented.

7. **Claims 1 and dependent claims 2-12 and 20 are rejected under 35 U.S.C. 102(f) because the applicant did not invent the claimed subject matter (see MPEP 2137).**

The Examiner notes that Claim 1 and dependent claims 2-12, 14 and 20 are directed toward the physical characteristics of a thermal control film for use in spacecraft. The disclosure

neither provides a working example of a thermal control film with a multi-layer interference filter having these physical characteristics nor any technical teachings about specific materials and their structural relationships that can be used in each layer of the claimed thermal control film; they state that they are relying upon companies such as 3M to develop film having the claimed properties. This suggests that the claimed invention is merely a derived use and application of a disclosed prior art material, "3M Radiant Mirror Film VM 2002" (page 9, lines 5-6), rather than an invention of the claimed subject matter.

8. **Claims 1-4, 6, 11-12 and 20 are rejected under 35 U.S.C. 102(b) as being anticipated by Lepore et al. (US Patent No. 5,373,305) as evidenced by the *Encyclopædia Britannica* ("infrared radiation." Encyclopædia Britannica. 2008. Encyclopædia Britannica Online. 27 Oct. 2008 http://www.britannica.com/EBchecked/topic/287964/infrared-radiation).**

**(Claim 1)** Lepore ('305) teaches a thermal control film for use in spacecraft comprising a multi-layer interference filter *('305, Col 2, at least two films, lines 37-38; Figs. 4 and 5)*.

Lepore ('305) describes that the RF-transparent antenna thermal membrane (film) should "significantly attenuate passage of infrared, visible and ultraviolet (UV) components of sunlight" and "should be transparent to radio-frequency signals (RF), which includes signals in the range between 30 to 300 MHz and 26 to 40 GHz, inclusive" *('305, Col 1, lines 26-35)*.

Lepore further states that an "ideal antenna sunshield membrane for use on communications spacecraft would exhibit all of the following characteristics: (1) Low RF loss; (2) Low solar absorbance ($\alpha$); (3) High IR (infrared) emittance ($\varepsilon$); (4) Low transmittance ($\tau$) of visible and infrared; (5) High tear strength; (6) Long term space stability--resistance to degradation caused by solar ultraviolet and ionizing radiation, thermal cycling, atomic oxygen;

(7) Sufficient electrical conductivity for electrostatic discharge (ESD) protection" *('305, Col 3, lines 15-28).*

As evidenced by *Encyclopædia Britannica,* "far infrared" is defined as wavelengths in the range of 50 to 1000 micrometers, whereas wavelengths within the range of the instant claim, 2.5-50 micrometers, are defined as mid-infrared.

Therefore, Lepore ('305) discloses a thermal control film for use in spacecraft comprising a multi-layer interference filter adapted to exhibit preselected high absorbency and emissive characteristics in the [far] infrared wavelength range, low absorbency characteristics in the solar spectrum range, and high transmissive characteristics in the microwave frequency.

**(Claims 2 and 6)** Lepore ('305) teaches a thermal control film according to Claim 1. The film structure, as disclosed by Lepore, has at least two dielectric membrane films, e.g. polyimide, that is coated on a surface with a semiconducting material, e.g. germanium, with the option of reinforcing materials such as glass fiber mesh or polyester fibers *('305, Col 6, lines 35-53).* The Examiner notes that germanium, closely related to silicon, is a semi-conducting metalloid that transmits microwaves, i.e. is RF-transparent and therefore does not consider germanium to be a pure metal. Hence, Lepore discloses a thermal control film where the film is free from metal (**Claim 2**) and the multi-layer interference filter is a polymeric structure (**Claim 6**).

**(Claims 3 and 11)** Lepore ('305) teaches the thermal control film according to Claim 1 (see above), where the film covers the active face of an antenna carried by the spacecraft and likewise teaches an antenna comprising a thermal control film according to Claim 1 covering the active face thereof *('305, Figs. 1-2; Claim 16).*

**(Claims 4, 12 and 20)** Lepore ('305) discloses a thermal control film according to Claims 1 and 2 (see above), wherein the film "material is flexible" *('305, Col 4, line 67)* as it is in the form of a "membrane or blanket" *('305, which the Examiner notes to be 'flexible', Col 5, line 66)*. Therefore, Lepore teaches that the thermal control film of Claims 1 and 2 is in the form of a flexible sheet (**Claims 4 and 12**). Lepore further discloses that the thermal control film is applied to a spacecraft antenna wherein the "multilayer membrane is held together by stitching around its periphery with two stitch lines on its face" *('305, Col 7, lines 53-54)*. Thus Lepore teaches an active face of a spacecraft antenna covered by a thermal control film in the form of a flexible sheet (**Claim 20**).

9. **Claims 1-2, 4, 6-7, and 12 are rejected under 35 U.S.C. 102(b) as being anticipated by Iacovangelo et al. (US Patent No. 6,587,263 B1).**

**(Claim 1)** Iacovangelo ('263) teaches a thermal control film *('263, radiative layer 308, Fig. 3)* for use in spacecraft comprising a multi-layer interference filter "comprising $SiO_2$, $SiO_xN_y$ and $Si_3N_4$ and has a low absorbency of electromagnetic radiation having wavelengths of approximately 200 nm to approximately 2500 nm [solar energy] and high absorbency and emissivity electromagnetic radiation having wavelengths of approximately 2.5 micrometers to approximately 25 micrometers" *('263, Abstract; Fig. 1; Claims 1-6 and 11)*. Regarding the microwave frequency transmissive properties, Iacovangelo uses the same materials for a multi-layer interference filter structure of Claim 1, therefore Iacovangelo teaches the thermal control film of the instant claim.

**(Claims 2, 6 and 7)** Iacovangelo ('305) teaches the limitations of Claim 1 wherein the film is free of metal and the multi-layer interference filter is a polymeric structure and comprises one or more layers of any combination of $SiO_2$, $SiO_xN_y$ and $Si_3N_4$ *('263, Col 6, radiative layer includes one or more layers of modulated $SiO_2/SiO_xN_y/Si_3N_4$ coatings)*. Therefore, Iacovangelo teaches the thermal control film of **Claims 2, 6 and 7**.

**(Claims 4 and 12)** Iacovangelo ('263) teaches the thermal control film of Claims 1 and 2. Iacovangelo further discloses that use of $SiO_2/SiO_xN_y/Si_3N_4$ materials for the thermal control film results in a reduction in breakage due to handling. Therefore, Iacovangelo teaches that the multi-layered interference filter sheet is flexible.

### *Claim Rejections - 35 USC § 103*

10. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

11. The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

12. **Claims 1-4, 6, 11-12 and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lepore et al. (US Patent No. 5,373,305) in view of "3M Radiant Mirror Film VM 2000F1A6" (3M VM2000).**

Regarding Claims 1-4, 6, 11-12, 14 and 20, the applicant claims particular physical properties of a thermal control film with a multi-layer interference filter: high absorbency and emissive characteristics in the [far] infrared wavelength range, low absorbency characteristics in the solar spectrum range, and high transmissive characteristics in the microwave frequency.

The present specification clearly admits that it is within the ordinary skill in the art to produce films having those properties (page 8, lines 1-2 and lines 21-24). The applicant additionally states that 3M produces films of this type (page 9, lines 5-6).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have optimized the films taught by 3M VM2000 for optimal thermal control because 3M VM2000 discloses that "3M Radiant Films can be die cut, sheer slit, coated to be UV and abrasion resistant, printed, and laminated to various substrates" and Lepore teaches optimization of physical properties of thermal control films *('305, Col 3, lines 15-28).*

Furthermore, it would have been obvious to one having ordinary skill in the art at the time of the invention to adjust the physical properties of the 3M VM2000 film for the intended application, since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. *In re Boesch*, 617 F.2d 272, 205 USPQ 215 (CCPA 1980).

13. **Claims 7 and 9-10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lepore et al. (US Patent No. 5,373,305) in view of Iacovangelo et al. (US Patent No. 6,587,263 B1).**

**(Claim 7)** Lepore ('305) and Iacovangelo ('263) teach the thermal control film of Claim 1 (see above).

Lepore fails to specifically teach that the multi-layer interference filter comprises one or more layers of any combination of $SiO_2$, $SiO_xN_y$ and $Si_3N_4$.

However, Iacovangelo ('263) teaches this multi-layer polymeric structure (see above).

Lepore teaches the disclosed invention except for the use of $SiO_2$, $SiO_xN_y$ and $Si_3N_4$ as one or more layers in the multi-layered interference filter of the thermal control film. However, at the time of the invention, it would have been obvious to one having ordinary skill in the art to include the silicon-based compositions taught by Iacovangelo ('263) in the thermal control film taught by Lepore ('305) because use of modulated $SiO_2/SiO_xN_y/Si_3N_4$ layers yields very good absorptivity and emissivity values *('263, Col 5, lines 24-25).*

**(Claims 9 and 10)** Lepore ('305) and Iacovangelo ('263) teach the thermal control film of Claim 1 (see above).

Lepore ('305) teaches that the thickness of the thermal control film comprises a germanium layer that can have a thickness of from about 150 to 900 angstroms (0.015 to 0.09 microns), and two dielectric layers between 0.0005 and 0.003 inches (13 to 76 microns), therefore a thermal control film with three layers as taught by Lepore has a thickness from about 26 to 150 microns *('305, Claims 1 and 9)* and the structure of the thermal control film may be multi-layered *('305, Fig.s 5 and 6).*

Iacovangelo teaches that the standard thickness of thermal control films known in the art is 0.002", i.e. 51 microns *('263, Col 1, line 51)* and discloses a thickness of the thermal control film of about 10 to 25 microns *('263, Claim 1)*.

Lepore and Iacovangelo both teach that the thickness of the thermal control films is within the range of the instant claims. Given that the thickness of the thermal control films is known in the art to depend on optimization of the thermo-optical properties of the multi-layer *('263, Col 7, lines 9-14)*, it would have been obvious to one having ordinary skill in the art at the time of the invention to adjust the thickness of the thermal control film for the intended application, since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. *In re Boesch*, 617 F.2d 272, 205 USPQ 215 (CCPA 1980).

14. **Claim 8 is rejected under 35 U.S.C. 103(a) as being unpatentable over Lepore et al. (US Patent No. 5,373,305) in view of Iacovangelo et al. (US Patent No. 6,587,263 B1) and Fischell (US Patent No. 3,671,286).**

Lepore ('305) in view of Iacovangelo teaches the thermal control film of Claim 7 and 15 (see above).

Lepore ('305) does not specifically point out that the thermal control film is in the form of a plurality of tiles.

Iacovangelo ('263) does disclose that thermal control films for spacecraft are typically known to often be in the form of 3"x3"x0.002" tiles, and that a spacecraft requires a large number of such pieces *('263, Col 1, lines 51 and 62-64)*.

Furthermore, Fischell discloses a thermal control film for spacecraft with a low absorptivity to emissivity ratio that can be "bonded in the illustrated tile-like fashion to the exterior skin of the satellite" *('286, Col 3, lines 11-12; Fig. 1)*.

Lepore discloses the claimed invention except for that the thermal control film is in the form of a plurality of tiles. However, given that tiles are known in the art as taught by Iacovangelo and that Fischell discloses that tiles are an effective way to radiate heat which is generated within the spacecraft while at the same time reflecting virtually all of the incident solar radiation to which the spacecraft is subjected when in a space environment *('286, Col 3, lines 13-17)*, it would have been obvious to one having ordinary skill in the art at the time the invention was made to cut the membrane or blanket taught by Lepore into tile like shapes, since it has been held that the configuration was a matter of choice which a person of ordinary skill in the art would have found obvious absent persuasive evidence that the particular configuration claimed was significant. *In re Dailey,* 357 F.2d 669, 149 USPQ 47 (CCPA 1966).

***Conclusion***

15. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

a. Chapter 3.6. "Antennas." Gilmore, David G. *Spacecraft Thermal Control Handbook*, Volume 1 - Fundamental Technologies (2nd Edition). American Institute of Aeronautics and Astronautics. 2002. Chapter 3.6, pages 80-81, discloses that thermal control films for antennas must provide protection from solar radiation to keep spacecraft temperatures cool, and must allow radio-frequency transmission. Further is disclosed

that thermal control films may be in the form of paints [liquid coating], insulation blankets, or low coefficient-of-thermal-expansion structural materials.

b. Harrison, John. "Investigation of Reflective Materials for the Solar Cooker." Florida Solar Energy Center, published 24 Dec. 2001. Harrison dates the 3M VM2000 radiant mirror film as of Dec. 24, 2001 and discloses use of 3M VM2000 Radiant Mirror film in a solar application and that a UV protective coating may be added as an additional layer.

15. Any inquiry concerning this communication or earlier communications from the examiner should be directed to APRIL C. INYARD whose telephone number is (571) 270-1245. The examiner can normally be reached on Monday - Friday 8:00 AM - 5:00 PM EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Joseph Del Sole can be reached on (571) 272-1130. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/APRIL C INYARD/
Examiner, Art Unit 4152

**/Joseph S. Del Sole/**

**Supervisory Patent Examiner, Art Unit 4152**